Asia-Pacific
Economic Cooperation

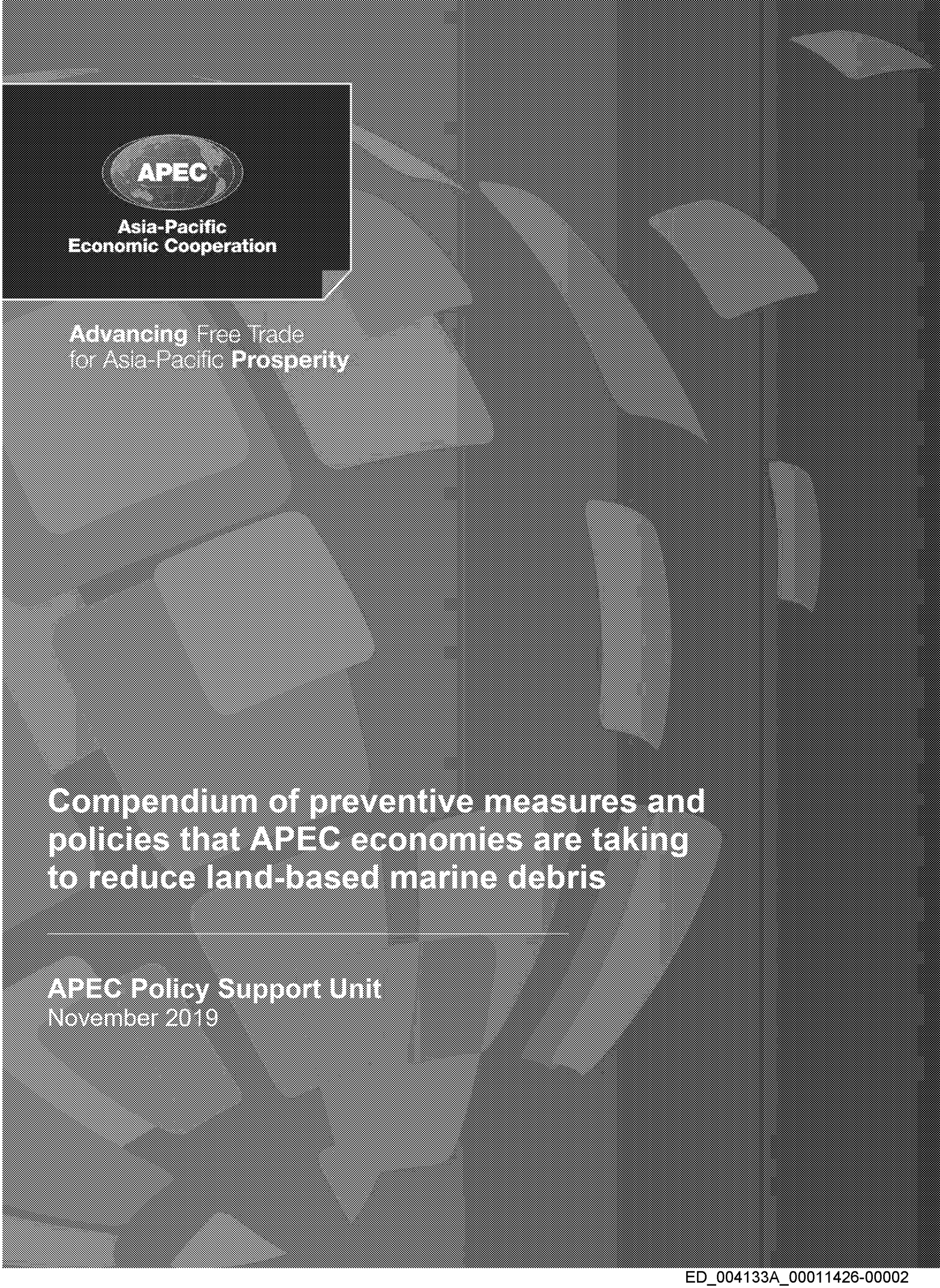
2019/SOM3/OFWG/021
Agenda Item: 4.B

Compendium of Preventive Measures and Policies That APEC Economies Are Taking to Reduce Land-Based Marine Debris - Draft Report

Purpose: Consideration
Submitted by: Policy Support Unit, APEC Secretariat

APEC
CHILE 2019

13th Ocean and Fisheries Working Group Meeting
Puerto Varas, Chile
20-21 August 2019



Advancing Free Trade
for Asia-Pacific **Prosperity**

Compendium of preventive measures and policies that APEC economies are taking to reduce land-based marine debris

APEC Policy Support Unit
November 2019

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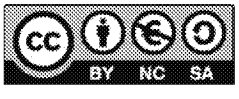
Produced for:
Oceans and Fisheries Working Group (OFWG)

APEC#210-SE-01.1



1. CONTENTS

1. INTRODUCTION

Marine debris (or marine litter) has been recognised as a growing problem globally with impacts to economies, environment (include the marine organisms and their ecosystems) and potentially human health. It is estimated that 80 percent of all marine debris are made up of plastics, a non-biodegradable, synthetic organic polymer. These plastic wastes have accumulated at such a high concentration in the Pacific Ocean (for decades) that a floating mass of wastes called The Great Pacific Garbage Patch, around 2,200km long and 800km wide, is formed. Experts estimate that about 80 percent of plastic waste in the oceans comes from land-based sources. Urgent measures are needed to control the increasing flow of plastic waste into the ocean.

Asia-Pacific Economic Cooperation (APEC) studies show substantial environmental, economic and social costs of marine debris to APEC Economies. The Oceans and Fisheries Working Group (OFWG) previously endorsed the need for a systematic capacity building program to address marine debris and approved the Capacity Building for Marine Debris Prevention and Management in the APEC Region Project in 2016[1]. As part of Chilean initiative to support the APEC Chile 2019 priorities, APEC Policy Support Unit (PSU) has proposed to develop a compendium of preventive measures for marine debris control in APEC Economies. Preventive measures are those aimed at reducing the amount of marine debris and contributing materials. Through a better understanding of each economy's preventive measures, APEC Economies can gain a better understanding of current best practices and will be able to identify areas for future collaboration.

APEC Economies' preventive measures and policies on marine debris were gathered with a direct survey and research focusing on areas including waste management measures, land-based and sea-based marine debris preventive measures, marine debris monitoring and current issues with plastic wastes.

This report summarises the outcomes of the questionnaires and create a compendium of preventive measures and policies that APEC Economies are taking to reduce land-based marine debris.

[1] https://www.apec.org/Groups/SOM-Steering-Committee-on-Economic-and-Technical-Cooperation/Working-Groups/Ocean-and-Fisheries

2. OVERVIEW

2.1 BACKGROUND

Marine debris has been a discussion topic in APEC since 1990 when it was first proposed by APEC Ministers as a new area of work[2]. Since then, APEC has held four oceans-related Ministerial Meetings and formed the OFWG and the Virtual Working Group on Marine Debris. At the last Ocean-related Ministerial Meeting in 2014, Ministers agreed to the Xiamen Declaration which encouraged cooperation in the reduction and mitigation of marine pollution (including from land-based sources and oil spills) and continuation and expansion of efforts to reduce marine debris. In 2016, APEC Leaders encouraged work to address the lack of effective waste management to reduce marine debris.

As a step towards improving waste management, an understanding of the APEC Economies' current preventive measures and policies in place to reduce the entry of plastic waste into the sea is required. A marine debris survey, therefore, has been developed to gather APEC Economies' responses on regulations and measures they have in place to tackle the marine debris issues. In this way, both developed and developing economies will be able to share their current best practices and find possible ways to collaborate amongst the Economies.

The key objective of the survey is to develop a compendium of preventive measures for marine debris control in APEC Economies. The scope of this study include:

- **Improving waste management measures** – by understanding how economies regulate waste management and development laws, and binding management instruments on waste management;
- **Improving the terrestrial environment** – through best practice landfill systems, and incentive schemes for efficient and sustainable waste storage solutions;
- **Prevent the entrance of marine debris** – by understanding how best to apply preventive measures such as regulation of submarine emissaries, emissions of naval artifacts and industrial waste; and
- **Enhancing the monitoring of marine litter** – through a shared understanding of the best monitoring measures and how economies can work together to monitor on a regional basis.

Additionally, the current measures focusing on plastic wastes are also included:

- **Plastic waste prevention policies** – this includes prevention and control measures such as reducing the unnecessary use of single-use plastic, the content of harmful substances, and the adverse impacts of waste on the environment; and
- **Effective management of plastic waste** – according to the principle of hierarchy which may include preparation for reuse, recycle, and other forms of recovery (including energy recovery and disposal).

2.2 MARINE DEBRIS POLLUTION

Marine debris is defined as any persistent solid material that is manufactured or processed and directly or indirectly, intentionally or unintentionally, disposed of or abandoned into the marine

[2] https://www.apec.org/Meeting-Papers/Annual-Ministerial-Meetings/1990/1990_amm

environment. The sources of marine debris can generally be classified into land-based and sea-based. Examples of these land-based and sea-based sources are listed below.

- Sources of land-based marine debris
  - land-fills;
  - rivers and floodwaters;
  - industrial outfalls;
  - discharge from storm water drains; and
  - untreated municipal sewerage
  - littering of beaches, coastal areas (tourism)
- Sources of sea-based marine debris
  - fishing and aquaculture;
  - shipping (e.g. transport, tourism);
  - offshore mining and extraction; and
  - illegal dumping at sea.

Marine debris comprises of many materials including glass, woods, metals, rubbers but an estimated 80% of them are made up of plastics. Plastics are non-biodegradable polymer that has a wide variety of applications and due to its low costs, the demand for its production continue to rise. It is estimated that 265 million tonnes of plastics were produced in 2010, and their demand is predicted to reach up to of 300 million tonnes by 2020. Due to a lack of proper management, these plastic wastes will end up in the ocean. These plastic wastes have accumulated at such a high concentration in the Pacific Ocean (for decades) that a floating mass of wastes called The Great Pacific Garbage Patch, around 2,200km long and 800km wide, is formed.

It is estimated that more than 150 million tonnes of plastics have accumulated in the world's oceans, while 4.6 to 12.7 million tonnes (from Jambeck et al.) are added every year. It is broadly assumed that approximately 80% of marine debris is land-based, with regional fluctuations (for example, in the Northeast Atlantic, shipping and fishing are very important litter sources). Marine debris has the potential to cause serious economic damage: losses for coastal communities, tourism, shipping and fishing. Whilst potential costs for APEC Economies are not available, costs for European Union economies for coastal and beach cleaning was assessed at almost €630 million per year, while the cost to the fishing industry could amount to almost €60 million, which would represent approximately 1% of total revenues of the EU fishing fleet (in 2010)[3].

Besides economic impacts, marine debris has an immense impact on the environment with accidental ingestion by marine animals and potential entanglement. Plastic does not biodegrade, but under the influence of Ultraviolet (UV) radiation, it breaks down again and again into smaller pieces called the Microplastics with size less than 5mm. These microplastics contain toxic substances that can travel up the foodchain and ultimately consumed by human. In some cases, marine debris pollutes beaches and coastlines which creates aesthetic problems that decreases tourism.

2.3 STUDY METHODOLOGY

[3] http://ec.europa.eu/environment/marine/good-environmental-status/descriptor-10/index_en.htm

In order to gather information on preventive measures for marine debris, a survey was distributed to all the APEC Economies in July 2019 and their responses sought. The survey responses received from APEC Economies were analysed, compiled and summarized in Section 3 of this report.

The survey methodology is summarised in the following sections.

2.3.1 Develop Questionnaire

The survey was developed in order to address key issues, such as the following:

- Understanding how APEC Economies regulate waste management and develop laws, and binding management instruments on waste management -
    - Current waste management regulatory framework
    - Any specific marine debris regulatory instruments
    - Proposed / future regulatory changes to address marine debris
- Understanding how the terrestrial environment can be improved to prevent land-based marine debris (preventive measures) -
    - Beach litter prevention
    - Best practice landfill systems
    - Incentive schemes for efficient and sustainable waste storage solutions
    - etc
- Understanding how the marine environment can be improved once land-based marine debris has reached the sea (remedial measures) –
    - Mitigation measures at sea
    - Biological / marine related remedial measures
- Understanding management instruments to prevent and mitigate marine debris at source
    - Policy and regulation
    - Industry-led e.g. incentive based or market-based instruments
    - Government-industry collaboration
    - Facilitation of investment in infrastructure improvements (e.g. investment in
    - sewerage systems, outfalls etc)
    - Public participation e.g. clean-ups, education
- Implications of land-based marine debris for APEC Economies –
    - Biological implications of marine debris, including understanding of key concerns for the APEC Economies (corals, microplastics, etc)
    - Socio-economic implications of marine anthropogenic litter, including identification of key affected sectors for APEC Economies (fisheries, tourism, shipping etc)
- Enhancing the monitoring of marine debris –
    - Current and best monitoring measures for various sources of marine debris
        - land-fills
        - rivers and floodwaters
        - industrial outfalls
        - discharge from storm water drains
        - untreated municipal sewerage
        - littering of beaches, coastal areas (tourism)
    - Recent actions taken by the APEC Economy
- Understanding of the current issues with plastic wastes –
    - Policy and regulation

    - Adopt the principles of waste hierarchy in plastic waste management
- Recommendations for good practice to be implemented, per sector group, per APEC Economy, and collaboratively across APEC Economies
    - Suggestions of how economies can work together to manage and monitor on a regional basis.

2.3.2 Complete Gaps Using Secondary Data

A review of secondary data was conducted in order to contextualise the survey results and provide an overview of the topic. The review will also support the bridging of gaps from the survey responses.

Secondary data was drawn from the following sources:

- APEC Member Economies' legislative websites
- Reference documents:
    - 'Capacity Building for Marine Debris Prevention and Management in the APEC
    - Region' Workshop Report, Korea 2017
    - Marine Litter in the Wider Caribbean: A Regional Overview & Action Plan"
    - (RAPMaLi), UNEP 2014
    - Marine Anthropogenic Litter, Open Access 20153
    - The European Union's Marine Strategy Framework Directive (MSFD)
- APEC OFWG publications

Research focused on APEC Economies, with reference to non-APEC Member Economies including Norway, and the European Union, to augment on good practice and emerging preventative measures and policies in this field.

3. APEC ECONOMIES MARINE DEBRIS SURVEY

This chapter summarises the responses of the marine debris survey from the APEC Economies and was completed with secondary data from research by Ramboll.

3.1 CHILE

3.1.1 Laws & Regulations

A summary of the waste management laws and regulations in Chile are found in Table 1 ~~Table 1~~ below.

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Table 1: Laws & Regulations associated with Waste Management & Marine Debris in Chile

Laws & Regulations	Brief Description	Waste Management Processes	Sources
Law No. 18695, CONSTITUTIONAL ORGANIC OF MUNICIPALITIES	• Establishes that the cleaning and decoration of the communes is a private function of the municipalities • Ensure domestic waste collection, transportation & disposal.	Collection, transportation & disposal	Domestic wastes
Law N°2.222, (Article N°142)	• Prohibit the disposal of debris or rubbish or other harmful substances, of any kind, which cause damage or harm to the waters subject to the national jurisdiction, in ports, rivers and lakes. • Regulates all of things related to navigation, ships, naval artifacts, ports, maritime terminals, navigation crew, contaminations control and preventive measures.	Disposal	Any debris or rubbish
Regulation N° 320, Environmental Regulation for Aquaculture,	• Require aquaculture facilities to adopt measures to prevent the dumping of waste. • Maintain the cleanliness of the beaches and beach areas surrounding the facility of cultivation of all solid waste generated by aquaculture.	Disposal, General waste management.	Aquaculture wastes
Regulation N°1.340, General regulation of Order, Security and Discipline in the ships and coast of the Republic	• Establishes the prohibition of throwing garbage or rubbish on beaches, there is no specific penalty fee, but the article 342 states that the Captain of the Port has the faculties to penalty. • Any infringement of the articles of this Regulation in which the penalty is not specified, will be sued to the offender to a discretionary fine that will be applied by the said official.	Disposal	Wastes from ships
Regulation N°1, Regulation for the Control of Aquatic Pollution	• Prohibit the disposal of rubbish or garbage or any wastes or harmful substances, of any kind, that cause or may cause damages in the	Disposal	All rubbish, garbage and wastes from

Laws & Regulations	Brief Description	Waste Management Processes	Sources
	waters subject to national jurisdiction and in ports, rivers and lakes. • Addresses the issue of Prevention of Contamination by Garbage from Ships and Naval Artifacts, that considers 5 articles.		ships and naval artifacts.

3.1.2 International Conventions

Chile has adopted legislations from international conventions, for management of marine debris, including:

- MARPOL Annex V Prevention of Pollution by Garbage from Ships: this is regulated by controlling Ships that are at port, dispose their garbage in Port reception facilities and the Garbage Management Plans are inspected.
- LONDON Convention 1972 and Protocol: this protocol treats on the Prevention of Marine Pollution by Dumping of Wastes and Other Matters.
- UN Convention on the Law of the Sea: this focuses the environmental scope throughout the Regional Sea Programmes. As a member in CCPS (Committee on Sustainable Consumption and Production), Chile supports its member states for an adequate valuation of their marine and coastal ecosystems in order to raise awareness of their economic importance for the benefit of their population. In addition, the CPPS as Executive Secretary of the 1981 Convention of Lima and the Action Plan carries out activities to monitor and control marine pollution in each of the member economies, allowing an up-to-date overview of the state of ocean health in the Southeast Pacific region.
- FAO Code of Conduct for Responsible Fisheries: the fisheries fleet is to obey the article "8.7 Protection of the aquatic environment", that states that garbage has to "Owners, charterers and managers of fishing vessels should ensure that their vessels are fitted with appropriate equipment as required by MARPOL 73/78".
- Other conventions include Basel Convention, Stockholm Convention and Minamata Convention

3.1.3 Preventive Measures

Based on the survey response, Chile's main sources of land-based marine debris are from:

1. Household and general littering (most common)
2. Tourism and coastal recreation
3. Waste management and collection
4. Toilet and sewer overflow (least common)

The main preventive measure is the passing of Law 21.100 which prohibits the commerce of plastic bags throughout Chilean territory. Reduction in plastic usage will therefore decrease the amount of plastics that will end up in the sea. Another measure is to increase awareness on marine debris impact on the environment. This can be done through campaigns organised by NGO or private organization with the support from Chilean government.

3.1.4 Remedial Measures

Remedial measure for marine debris is the beach cleanup which occurs during International Coastal Cleanup that is an economy-wide event organized by DIRECTEMAR (The General Directorate of the Maritime Territory and Merchant Marine). The programme aims to prevent garbage from beaches entering the sea and promoting awareness on impact of marine debris to public through schools and other social media.

Waste management measures that are most relevant (as ranked) to Chile are:

1. Ban of certain products (e.g. single-use plastics)
2. Voluntary beach clean-up programs
3. Voluntary, centralised collection of certain products in exchange of a community benefit
4. Phasing-out / Ban of certain items or materials
5. Underwater clean-ups in hot-spot areas (e.g. can be divers or using 'Sea-Trash Collector")
6. Improved cleaning operations in certain areas
7. Promote recycling campaigns

Based on the survey response, Chile's main sources of sea-based marine debris are from:

1. Aquaculture (most common)
2. Professional and recreational fishing
3. Shipping Sector
4. Port activities
5. Offshore industries (least common)

The regulations and laws associated with sea-based marine debris from submarine emissaries, naval artifacts and aquaculture is as described in Section 3.1.1 above.

The remedial measures for marine debris will include:

- Establish programmes for identifying and mapping of garbage sinks across the coastline.
- Generate collaborative alliances (private/public/academia) for monitoring and collecting of marine debris.
- Improve enforcement of the MARPOL Annex V and control of the fishing nets and fishing gear like plastic in the fishing fleet, from SMEs to big fisheries.
- Increase awareness raising within the shipping, aquaculture and fishing sector.
- Ensure adequate port reception facilities are in place.
- Develop voluntary programs for reducing plastic packaging on board vessels.

Chile has also established a National Work Group to address issues on Marine Debris and Microplastics.

3.1.5 Research & Funding

Funding marine debris research is available from Chile government and provincial level, as well as local universities. For example, Científicos de la Basura, a citizen science program, has received funding from National Commission for Scientific and Technological Research to study marine debris and microplastics throughout Chile.

3.1.6 Marine Debris Monitoring

Table 2: Chile Marine Debris Monitoring

Monitoring Methods	Source Identification Methods	Detailed Description	Findings
GESAMP method	Anthropogenic litter in beaches	• Begun in 2019. • Led by the Maritime Authority • Monitoring is conducted by the marine biologist and environmental engineers that work at GESAMP, in some places with help from universities students. • Frequency: every 6 months • Location: 13 beaches throughout Chile.	Still in progress.

3.1.7 Current Measures on Plastic Wastes

The plastic waste is collected, transported and disposed of together with the rest of the waste generated at the household level, mainly to be disposed of in landfills. Along with the above, there are some systems of voluntary delivery, in green points or clean points of PET plastic for subsequent recycling.

Chile has made public commitment to move towards a "New Plastics Economy", and in October 2018, signed the "Global Commitment of the New Economy of Plastics" by the UN to commit in implementing measurable policies to make and report tangible progress by 2025. Some commitments include:

1. Take actions to eliminate single-use plastic containers and utensils that are problematic or unnecessary through redesign and innovation.
2. 100% of plastic containers and packaging must be designed to be recyclable, reusable or compostable.
3. 1/3 of residential and non-domiciliary plastic containers and packaging must be effectively recycled, reused or composted.
4. The plastic containers and packagings must have -in their different formats- an average of 25% recycled material.

With the commitment above, Chile has invited all companies and organizations including NGOs, universities, consumer associations, municipalities to voluntarily join the Pact and contribute to the development of the new economy of plastics.

A new law (No. 20,920) also introduces the Extended Producer Responsibility (REP) for packaging, among which are plastic containers. It is expected that during the year 2022 the REP for containers and packaging will come into force.

3.1.8 Challenges & Opportunities

Marine debris pollution has economic implications on Chile aquaculture, tourism and fisheries industries. These debris were also known to block the uptake of water by the desalination and

thermoelectrical plants. Additionally, the marine debris also has a negative impact to the marine animal due ingestion and entanglement.

The 5 most relevant gaps on plastic packaging in Chile is as identified in table 3 below:

Table 3: Most Relevant Plastic Packaging Gaps in Chile

Rank	Most relevant gaps in plastic packaging	Explanation
1	Lack of awareness or incentives to separate waste for recycling	Not provided.
2	Lack of measures to reduce the production of plastic packaging (e.g. bags, bottles, EPS fish boxes)	Not provided.
3	Production and consumption patterns based on single-use/disposable items rather than reduce and re-use	Not provided.
4	Deficient separate collection infrastructure for plastic packaging waste	Not provided.
5	Decoupling between design/production and recycling – products are designed without its whole life-cycle in view	Not provided.

Direct preventive measures worth considering by Chile and ranked based on the level of priority are:

1. Eco-design to avoid waste generation or to enhance reuse or recyclability (Highest priority)
2. Enhanced waste collection on land
3. Enhanced waste treatment chains, avoiding escapes of waste to the environment (e.g. daily covered or better managed landfills)
4. More public bins to avoid fly-tipping
5. Better acceptance facilities for ships

Indirect preventive measures worth considering by Chile and ranked based on the level of priority are:

1. Awareness Raising & Information: measures focusing on changing behaviour, labelling and certification, communication, education, training & etc (Highest priority)
2. Legal & Obligations: command and control measures.
3. Enhanced Enforcement
4. Subsidies, Taxes & Levies: direct positive and negative economic incentives.
5. Other Economic of Market-based Instruments: green public procurement, purchase specifications, price regulation, costs for goods and services, fee-based systems & trading systems.

Overall, Chile has proposed APEC Economies collaborate in the following:

1. Determine the best type of monitoring to see the effectiveness of the measures taken to prevent marine debris.
2. All Economies adopt the Roadmap on MD to put an end the incoming of MD in the ocean.
3. Establish a yearly Economy workshop held by each economy to: help level all economies to establish similar preventive measures to prevent MD enter the ocean and control land based marine debris, to compare results of monitoring programs and help economies to level up, and in these workshops give building capacities to economies that are less developed.

3.2 JAPAN

3.2.1 Laws & Regulations

A summary of the waste management laws and regulations in Japan are found in Table 4~~Table~~ 4 below.

Table 4: Laws & Regulations associated with Waste Management & Marine Debris in Japan

Laws & Regulations	Brief Description	Waste Management Processes	Sources
Waste Management and Public Cleansing Law	• Establish a clean-living environment and improving public health through the restriction of waste discharge, appropriate sorting, storage, collection, transport, recycling, disposal of waste	sorting, storage, collection, transport, recycling, disposal, incineration, composting, landfill	Municipal & Industrial waste
Act on Promoting the Treatment of Marine Debris Affecting the Conservation of Good Coastal Landscapes and Environments to Protect Natural Beauty and Variety and Marine Environment.	• Provide basic principles for measures required for the smooth removal action of marine debris and effective reduction of its generation • Define the responsibilities of the national and local governments, business entities and the people of Japan, while setting out the basic policy established by the national government and other necessary matters for promoting measures against articles that drift ashore • Provide funding to municipalities to collect & process marine debris	Reduction at source, treatment, Recycling	Marine litter
Law Relating to the Prevention of Marine Pollution and Maritime Disaster	• Establish measures to prevent marine pollution and maritime disasters by controlling discharge of wastes from ships, offshore facilities	Disposal	Wastes discharge from ships and offshore facilities
Container and Packaging Recycling Law	• Establish the responsibilities for consumer, municipalities and business on proper handling of waste through sorting, collection and recycling.	Sorting, collection, recycling.	General waste

3.2.2 International Conventions

Japan has adopted measures to address marine debris issues from treaties including:

- International Convention for the Prevention of Pollution from Ships
- Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter
- International Convention on Oil Pollution Preparedness, Response and Cooperation
- International Convention for the Control and Management of Ships' Ballast Water and Sediments

Restrictions defined in these conventions were incorporated in the Law relating to the Prevention of Marine Pollution and Maritime Disaster.

3.2.3 Preventive & Remedial Measures

To prevent marine plastic pollution, Japan has initiated the Resource Circulation Strategy for Plastics, which aims to have zero marine plastic pollution through the emphasis on 3Rs (Reduce, Reuse & Recycle), proper waste handling, prohibition of littering and illegal dumping and promotion of clean up activities.

Japan has the National Action Plan for Marine Plastic Litter that focuses on prevention of marine litter form entering the ocean. Some measures from the action plan include:

1. Promotion of proper waste management system
2. Prevention of littering, illegal dumping and unintentional leakage of waste into the oceans
3. Collection of scattered waste on land
4. Recovery of plastic litter in the oceans
5. Innovation in development of alternative materials and conversion to those
6. Collaboration with stakeholders
7. International cooperation for promoting measures in developing economies
8. Survey on actual situations and accumulation of scientific knowledge.

When drafting these measures, Japan has considered feedbacks from various stakeholders including public or residents when they revise their local plans and make efforts toward understanding the status of measures implemented.

3.2.4 Research

Additionally, Japan's Ministry of Environment has funded a marine plastic litter research conducted by Kyushu University from 2018 to 2020. The research aims to understand the distribution of marine plastic in the ocean from its coasts to a global scale, the environmental impact of marine plastics and improving the measuring methods of marine plastics.

3.2.5 Partnership

Partnership and joint efforts between government, private institutions and public are also established for the prevention of marine debris pollution. For example, the Marine Plastic Public Private Innovation Partnership created by Japanese companies to support innovations on substituting material for plastic. An economy-wide cleanup campaign, UMIGOMI Zero Week, a joint effort with Nippon Foundation and participation from more than 800,000 people to reduce marine waste.

3.2.6 Marine Debris Monitoring

Marine debris monitoring is implemented as required under the Act on Promoting the Treatment of Marine Debris Affecting the Conservation of Good Coastal Landscapes and

Environments to Protect Natural Beauty and Variety and Marine Environment. Table 5~~Table 5~~ summarises the details of marine debris monitoring conducted by Japan.

Table 5: Marine Debris Monitoring in Japan

Monitoring Methods	Source Identification Methods	Detailed Description	Findings
Beach survey	Classification	• Conducted by Japan's Ministry of Environment • Annual monitoring since 2009. • At 10 locations in Japan	Mainly plastic bottles, fishing gears, other plastic materials and natural articles such as wood (high proportion)
Floating debris survey	Classification	• Conducted by Japan's Ministry of Environment • Annual monitoring since 2014. • At 2 to 3 bays and around 70 stations in offshore areas	Mainly plastic materials and natural articles such as wood (high proportion)
Sea bed debris survey	Classification	• Conducted by Japan's Ministry of Environment • Annual monitoring since 2014. • At 2 to 3 bays and around 3 stations in offshore areas	Mainly plastic and metal materials

3.3 NEW ZEALAND

3.3.1 Laws & Regulations

A summary of the waste management laws and regulations in New Zealand is provided in Table 6~~Table 6~~ below.

Table 6: Waste Management Laws & Regulations in New Zealand

Laws & Regulations	Brief Description	Waste Management Processes	Sources
Litter Act 1979 Local Government Act 2002	• Provides a framework and powers for local authorities to decide which activities they undertake and the way they will undertake them; and promotes the accountability of local authorities to their communities • General act on litter management	Collection	Solid wastes from household
Resource Management Act 1991	• The purpose of the Act is to promote the sustainable management of natural and physical resources • Prevent the dumping of wastes in coastal marine area (including from any ship, aircraft or offshore installation)	Storage, disposal	All wastes
Hazardous Substances and New Organisms Act	• Purpose of this Act is to protect the environment and the health and safety of people and communities, by preventing or managing the adverse effects of hazardous substances and new organisms	Storage, treatment, disposal	All wastes

Laws & Regulations	Brief Description	Waste Management Processes	Sources
	• This include wastes (hazardous) which could enter the ocean.		
Land Transport Act 1988 Dangerous Goods Act 2005	• Sets out the requirements for the safe transport of dangerous goods on land and in New Zealand	Transportation	All wastes
Waste Minimisation Act 2008	• Promote the reduction of waste generation and disposal • Imposes levy on all wastes disposed at landfill to generate funds for government to minimise wastes • Prohibit the sale and manufacture of wash-off products that contain plastic microbeads for the purposes of exfoliation, cleaning, abrasive cleaning or visual appearance of the product.	Treatment, disposal	All wastes

3.3.2 International Conventions

In general, New Zealand's regulations associated with marine debris prevention include:

- Maritime Transport Act 1994
- Resource Management Act 1991
- Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012
- Resource Management (Marine Pollution) Regulations 1998
- Marine Protection Rules Parts 170 & 180

These legal frameworks implemented are New Zealand's obligations under MARPOL Annex V and LC/LP, to regulate the dumping and discharge including garbage from any ship or offshore installations under New Zealand's jurisdiction.

3.3.3 Preventive Measures

New Zealand has recently implemented the ban of single-use plastic shopping bags, preventing businesses from providing these bags. The ban applies to all new single-use plastic shopping bags with handles that are made of plastic up to 70 microns in thickness. This include biodegradable, compostable and oxy-degradable plastics bags.

Other preventive measures adopted by New Zealand for ***land-based*** marine debris include:

- **Ocean Clean Sweep** – This initiative aims to help operators in the plastics industry to reduce the loss of pellets to the environment. The manual enables operators to audit their own sites and provides advice on establishing procedures to prevent pellet loss into the environment.
- **Well Being Budget** - The Wellbeing Budget provides $4 million over four years to help the Ministry for the Environment work on improving resource efficiency and shifting New Zealand to a zero-waste economy. It will build on work underway to

improve the data on waste, develop mandatory product stewardship schemes for tyres, lithium batteries and refrigerants. The new funding will help implement national resource recovery work in response to China's waste ban and action on single-use and problem plastics.

3.3.4 Remedial Measures

Some of the remedial measures adopted by New Zealand include the beach and seafloor cleanup activities. For example, Ghost Fishing New Zealand, an international organisation made up of voluntary divers to conduct seafloor cleanup. Project Baseline, a charitable organisation, which has a database on cleanup activities and allow public document of data before and after cleanup.

Based on the survey responses, some of the waste management measures that are most relevant (as ranked) to New Zealand are:

1. Improved enforcement on improper disposal into waterways
2. Phasing-out / Ban of certain items or materials
3. Deposit-refund scheme (e.g. Extended Producer Responsibility)
4. Voluntary phasing-out or minimisation of sale of certain products
5. Promote recycling campaigns
6. Ban of certain products (e.g. single-use plastics)
7. Redesign of products (e.g. alternative biodegradable materials or reduce the use of non-biodegradable components in the product)
8. Voluntary beach clean-up programs
9. Awareness raising for good waste management offshore
10. Promote Green Procurement (e.g. purchasing of products with ecolabels)

New Zealand has developed its policies and measures ensure it is aligned with international legislations, taking into considering public consultations and applications to all businesses.

Like other economies, New Zealand's economy to date has been based on a 'take, make and dispose' model, which treats nature and the resources it provides as 'free' and disposable. More materials recovery and local re-processing infrastructure helps us shift to a more sustainable and efficient circular economy, where products are designed to have a long life, and materials can be recovered and easily reused, recycled, remanufactured.

3.3.5 Implications of Marine Debris

New Zealand Environment Committee has considered a briefing on the scale, impact, and sources of plastic pollution in New Zealand's coastal waters, and in it shared about the harmful effects of plastics or microplastics to marine biodiversity, ecosystem and the potential health impact to human.

3.3.6 Funding

The Waste Minimisation Act 2008 imposes a levy on all waste disposed of in landfills to generate funding to help local government, communities and businesses minimise waste. Half of the levy money goes to territorial authorities (city and district councils) to spend on

promoting or achieving the waste minimisation activities set out in their waste management and minimisation plans (WMMPs). The remaining levy money (minus administration costs) is put into the Waste Minimisation Fund. The fund is for waste minimisation activities in New Zealand. For example, two projects that have been funded through the WMF include:

- **Keep New Zealand Beautiful**, a non-profit organisation that focuses on keeping New Zealand communities clean, safe and beautiful. The project increases environmental awareness through a range of sustainability and education programmes. This study is part of a three-year litter prevention project Keep New Zealand Beautiful is undertaking in partnership with the Ministry for Environment. As part of this litter project Keep New Zealand Beautiful is undertaking a comprehensive policy review, implementing a national litter audit, developing litter specific educational resources for schools and creating a national litter hub website.
- **Sustainable Coastlines** is a multi-award winning New Zealand charity, whose mission is to enable people to look after the coastlines and waterways they love. The project will roll out a litter education curriculum for schools, establish a national litter database alongside and bring these programmes to communities around New Zealand. Funded by the Ministry for the Environment's Waste Minimisation Fund, the project also works alongside collaborators from the Department of Conservation and Statistics New Zealand.

Additionally, New Zealand institutions provided numerous funding opportunities for driving innovations in addressing marine debris issues through:

- The Endeavour Fund administered by the Ministry for Business, Innovation and Employment
- National Institute of Water and Atmospheric Research
- Institute of Environmental Science and Research
- The National Science Challenges administered by the Ministry for Business, Innovation and Employment

3.3.7 Marine Debris Monitoring

Marine debris is monitored as part of beach cleanup activities by various voluntary groups in New Zealand and details are provided in Table 7~~Table 7~~ below.

Table 7: Marine Debris Monitoring in New Zealand

Monitoring Methods	Source Identification Methods	Detailed Description	Findings
Data collection of beach clean-ups	Local adaptation of the United Nations Environment Program / Intergovernmental Oceanographic Commission Guidelines on Survey and	• Sustainable Coastlines have launched a 'Litter Intelligence' database. This is a long-term programme that collects litter data, provides powerful insights about the problem, and inspires widespread action for solutions. • Led by New Zealand charity Sustainable Coastlines, the programme works in close collaboration with the Ministry for the	Mainly plastics

Monitoring Methods	Source Identification Methods	Detailed Description	Findings
	Monitoring of Marine Litter	Environment, Department of Conservation and Statistics New Zealand. • Locations: 69 monitoring sites	

3.3.8 Challenges

The main challenge for New Zealand on marine debris pollution is the lack of relevant marine debris data to understand the extent of impact and the gaps in materials recovery and waste infrastructure.

The 5 most relevant gaps on plastic packaging in New Zealand is as identified in Table 8~~Table 8~~ below:

Table 8: Most Relevant Plastic Packaging Gaps in New Zealand

Rank	Most relevant gaps in plastic packaging	Explanation
1	Production and consumption patterns based on single-use/disposable items rather than reduce and re-use	-
2	Lack of measures to reduce the production of plastic packaging (e.g. bags, bottles, EPS fish boxes)	-
3	Decoupling between design/production and recycling – products are designed without its whole life-cycle in view	-
4	Lack of awareness or incentives to separate waste for recycling	-
5	Inappropriate behaviour when disposing litter (e.g. during activities along the coast, particularly impact related to tourism, etc.)	-

3.3.9 Opportunities

Direct preventive measures worth considering by New Zealand and ranked based on the level of priority are:

1. Eco-design to avoid waste generation or to enhance reuse or recyclability (Highest priority)
2. Enhanced waste treatment chains, avoiding escapes of waste to the environment (e.g. daily covered or better managed landfills)
3. Enhanced waste water treatment
4. Enhanced waste collection on land
5. Better acceptance facilities for ships (Lowest priority)

Indirect preventive measures worth considering by New Zealand and ranked based on the level of priority are:

1. Awareness Raising & Information: measures focusing on changing behaviour, labelling and certification, communication, education, training & etc Inland clean-up actions (Highest priority)
2. Research Oriented Measures: e.g. on prevention, recyclability & biodegradability.

3. Monitoring: in function of awareness raising, source and loophole detection & further policy planning.
4. Other Economic of Market-based Instruments: green public procurement, purchase specifications, price regulation, costs for goods and services, fee-based systems & trading systems.
5. Legal & Obligations: command and control measures.

The main recommendation for APEC Economies to collaborate is to start creating an information repository and build on existing material to develop guidelines or principles where there are gaps.

3.4 CHINA

3.4.1 Laws & Regulations

China remains the economy with the largest population in the world at 1.44 billion based on a United Nations population estimates and projections[4]. Municipal solid wastes generation are increasing due to the populations, economic growth and rapid urbanisation. In addition, China was the world's largest waste importer for decades until the import ban on solid wastes including plastic waste, unsorted paper waste and textile waste since January 2018. China since has shifted their focus on municipal waste management.

A summary of the waste management laws and regulations in China are found in Table 9~~Table 7~~ below.

Table 9~~7~~: Waste Management Laws & Regulations in China

Laws & Regulations	Brief Description	Waste Management Processes	Sources
Law of the People's Republic of China on the Prevention and Control of Environmental Pollution Caused by Solid Waste[5] (Revised draft)	• Emphasize the importance of preventing environmental pollution during the solid waste management process through proper waste collection, storage, transportation, treatment, disposal and source reduction. • Require Governmental District/City and solid waste management organisations to report solid wastes data including types, production quantity, status of disposal & etc. Info must be publicly available. • Required to engage qualified organisations for municipal waste transportation. • Importation of restricted solid waste and interprovincial transport of solid wastes are only allowed with the authorities' approval. • Solid waste treatment shall meet relevant pollution control standards including *Standard for pollution control on the municipal solid waste incineration* (GB 18485-2014) and	Collection, storage, transportation, treatment, disposal and source reduction.	Municipal solid wastes; Agriculture; Livestock and farming on a large scale; Mining; Industrial solid waste; Imported hazardous wastes.

[4] https://www.un.org/en/sections/issues-depth/population/
[5] http://www.mee.gov.cn/gkml/sthjbgw/stbgth/201807/t20180717_446712.htm

Laws & Regulations	Brief Description	Waste Management Processes	Sources
	Technical guidelines for solid waste treatment & disposition engineering (HJ 2035-2013). • Prevent environmental pollution caused by illegal solid wastes storage, disposal or dumping. • Solid waste disposal shall meet relevant pollution control standards such as *Standard of assessment on municipal solid waste landfill.* • Establish production standards to prevent over-packaging. Promote the design and manufacture of recyclable.		
Environmental Protection Law of the People's Republic of China	• General environmental law on environmental protection, prevent pollution, safeguard public health, promoting of sustainable economic and social development. • Encourages eco-friendly or recycled product to reduce wastes. • Promote sorting and recycling of municipal solid waste. • Prohibition of dumping wastes in sea	Collection, recycling, transportation and disposal.	Municipal waste, industrial and agricultural wastes.
Law of the People's Republic of China on Evaluation of Environmental Effects	• Requires evaluation of environmental effects or Environmental Impact Assessment (EIA) of a construction project prior to its development. • EIA report shall include impact assessment, preventive & mitigation measures as well as a monitoring plan for the project. • Public consultation and review of the EIA is required.	Source reduction	Construction wastes
Regulations for the Administration of the Recovery and Disposal of Waste Electric and Electronic Products	• Focus on the recovery and disposal of waste electrical and electronic product and promoting the development of a circular economy.	Recycling, disposal and recovery.	Electrical and electronic wastes.
City Appearance and Environmental Sanitary Management Regulations	• Provide guidelines for municipal solid waste disposal practices.	Disposal	Municipal solid wastes

China's legal framework applicable for marine waste management is the *Marine Environmental Protection Law of the People's Republic of China, 2000*. The law aims to reduce both the land-based and sea-based debris from entering the sea. In relation to marine debris, the disposal of garbage on beaches and seashores is prohibited. All vessels and ports within China's jurisdiction should also have their garbage storage facilities and measures to prevent any waste discharge into the sea. Permit shall be obtained for any vessels who wants to dump waste within the Chinese marine environment.

The law is enforced by China's Maritime and Fishery Department, which can impose administrative penalties and provide incentives for the reporting of illegal dumping activities (*Article 5* of the law). The authorities can impose penalties or order a vessel to make corrections within a stipulated timeframe on owner or operator of the ship when:

- Pollutants or other substance prohibited under the Marine Environmental Protection Law are discharged into coastal waters;
- Failure to comply with the Marine Environment Protection Law which also stipulates that pollutants shall not be over-discharged into the ocean;
- Discharging of wastes in to the ocean without obtaining a valid dumping permit;
- Failure to take immediate actions after causing marine environmental pollution due to accidents or unexpected events.

China is part of the International Convention for the Prevention of Pollution from Ships (MARPOL), and has incorporated regulations from Annex V into its national legislation. One such example is the provision of sufficient waste facilities at ports and terminals to meet the needs of arriving ships.

3.4.2 Preventive & Remedial Measures

Waste management measures that are most relevant (as ranked) for China are:

1. Voluntary beach clean-up programs
2. Improved enforcement on improper disposal into waterways
3. Improved cleaning operations in certain areas
4. Promote recycling campaigns
5. Awareness raising for good waste management offshore
6. Levy or tax on certain products (i.e. frequently end up as marine debris such as plastic bags & packaging)
7. Ban of certain products (e.g. single-use plastics)
8. Improved enforcement of current maritime legislation
9. Promotion of waste collection at the port
10. Underwater clean-ups in hot-spot areas (e.g. can be divers or using 'Sea-Trash Collector")

In development of the waste management measures, good regulatory principle has been applied. These policies will be standardized and fair to all producers and consumers. It will be first implemented in one or several cities as trial to gather feedbacks prior to larger scale implementation. Stakeholder consultations are conducted throughout the policy development process and all relevant feedbacks are taken into considerations. Feedbacks are monitored regularly following policy implementation. If implementation is unsuccessful, the policy will be withdrawn to save resources.

China's central and provincial governments have funds to prevent and control marine pollution (e.g. Blue Bay Action Plan). Almost all coastal municipal governments also have budgets for solid waste disposal. Some cities such as Xiamen, Shenzhen, Weihai and Wenzhou, have also formulated plans to allocate special funds in the field of marine debris.

Current research studies are focused on product substitution and solid waste management technology. Their sources of funding include departmental functional funds, natural science funds and social science funds from the government.

3.4.3 Land-based Marine Debris Preventive Measures

Based on the survey response, China's main sources of land-based marine debris are from:

1. Household and general littering (most common)
2. Waste management and collection
3. Tourism and coastal recreation
4. Toilet and sewer overflow
5. Agricultural plastic film
6. Industrial activities (least common)

The main preventive measures for land-based marine debris are enforcement by patrolling on waterways and product substitution to reduce pollution. Water policemen and cleaners are deployed to patrol the waterways to prevent illegal dumping of wastes into the sea. However, this may not be effective for rural streams which are inaccessible. Garbage from the riverbanks will eventually flow to the ocean creating marine debris.

To prevent and mitigate marine debris at source, restriction on use of disposable plastic bags and promotion on use of biodegradable plastics were implemented. The production, sale and use of plastic shopping bags with thickness less than 0.025mm are prohibited economy-wide in China from 1st June 2008. The measure is partially effective as it is difficult to control the excessive use of plastic bags by consumers. The plastic bags are commonly use in food packaging and cannot be prohibited due to lack of an alternative eco-friendly bag. Only the larger markets can enforce the restriction of plastic bags use. Another mitigation is to encourage scientific research and produce film mulches and commodity packaging that are recyclable or biodegrade in the environment. However, there are no products that can biodegrade rapidly in the composting environment.

The key concern for China is potential biological impacts due to the high level of microplastics in the sea. Research in 2016 showed that the density of microplastics in the surface layer of sea water near China is 0.29 per square metre. Taking a case discovered by Guangdong Maritime Police as an example, 564 tons of domestic waste were dumped into the sea, resulting in an estimated economic loss of 1.65 million yuan for ecological restoration.

The most effective remedial measures proposed would be to start the clean up on areas with high level of marine debris such as mangroves. This would require working with Non-governmental organisations (NGO) to conduct regular clean-up activities at these mangroves.

3.4.4 Sea-based Marine Debris Preventive Measures

Based on the survey response, China's main sources of sea-based marine debris are from:

1. Aquaculture (most common)
2. Professional and recreational fishing
3. Shipping Sector
4. Port activities
5. Offshore industries (least common)

The remedial action for sea-based marine debris will be to conduct submarine debris salvage at specific sea areas such as harbours, estuaries and aquaculture areas (common source of sea-based marine debris).

3.4.5 Marine Debris Monitoring

The marine debris monitoring method implemented by China and their details are provided in Table 10~~Table 7~~ below.

Table 10~~7~~: Marine Debris Monitoring in China

Monitoring Methods	Source Identification Methods	Detailed Description	Findings
Sea surface trawl	Classified Counting (plastic types)	• Conducted by various marine environmental monitoring stations at sea. • Frequency: Annually. • Location: Numerous sites around China.	Plastic bags and packaging are the most common
Submarine trawl	Classified Counting (plastic types)	• Conducted by various marine environmental monitoring stations at sea. • Frequency: Annually. • Location: Numerous sites around China.	Plastic bags and packaging are the most common
Beach survey	Classified Counting (plastic types)	• Conducted by various marine environmental monitoring stations at sea. • Frequency: Annually. • Location: Numerous sites around China.	Plastic bags and packaging are the most common

With the monitoring conducted, there is an increase in public awareness on the extent of marine debris pollution issue around China.

3.4.6 Current Measures on Plastic Wastes

The current practice in China for plastic wastes is to recycle those valuable plastics whilst those of low economic value are disposed in landfill. With the development of plastic waste classification (or sorting), the proportion of waste being incinerated and recycled has increased. The measure to increase plastic recycling is economy-wide and requires collaboration between garbage recycler, consumer and the local government. Mandatory garbage sorting for all public institutions and companies will also be implemented across 46 cities in China by 2020. In some cities, the classification of plastic garbage is strictly enforced. Failure to classify plastic garbage according to the requirements will be fined.

Polices and measures for single-use plastic are the restriction of disposable plastics and promotion of using recyclable or biodegradable plastics (as described in Section above).

The principle of waste hierarchy has been adopted in which single-use plastic production is restricted or minimized, followed by recycling or disposal at landfill. By 2020, municipal solid waste classification and treatment systems will be basically built in 46 key cities. On June 25, 2019, the Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste (Revised Draft), including the Mandatory Classification of Domestic Waste, was submitted for consideration. Compulsory classification of domestic waste will be fully implemented.

3.4.7 Challenges & Opportunities

The main challenge faced by China when tackling marine debris issues is the inadequate waste management infrastructure in rural areas. Efforts to increase the infrastructure at these rural areas were also ineffective.

The 5 most relevant gaps on plastic packaging in China is as identified in Table 11~~Table 8~~ below:

Table 11~~8~~: Most Relevant Plastic Packaging Gaps in China

Rank	Most relevant gaps in plastic packaging	Explanation
1	Production and consumption patterns based on single-use/disposable items rather than reduce and re-use	Because the income of residents is still not high and the demand is strong, the society has the inertia to use high-yield and low-cost disposable goods.
2	Insufficient collection coverage of municipal waste	Rural areas which are less accessible will have lesser frequency of collection of recyclables.
3	Lack of awareness or incentives to separate waste for recycling	Older generation are used to waste sorting for recycling, but there is a lack of awareness in younger generation to recycle and/or require more time to adapt.
4	Inappropriate waste collection and separation facilities (e.g. bins without lids in coastal areas)	Lack of separation facilities in most areas.
5	Inappropriate behaviour when disposing litter (e.g. during activities along the coast, particularly impact related to tourism, etc.)	As incomes rise, such behaviour is declining rapidly.

Direct preventive measures worth considering by China and ranked based on the level of priority are:

1. Enhanced waste collection on land (Highest priority)
2. Eco-design to avoid waste generation or to enhance reuse or recyclability
3. Installation of Video surveillance facilities or floating debris interception activities in streams passing through residential areas.
4. More public bins to avoid fly-tipping
5. Beach clean-up actions (Lowest priority)

Indirect preventive measures worth considering by China and ranked based on the level of priority are:

1. Awareness Raising & Information: measures focusing on changing behaviour, labelling and certification, communication, education, training & etc
2. Enhanced Enforcement
3. Other Economic of Market-based Instruments: green public procurement, purchase specifications, price regulation, costs for goods and services, fee-based systems & trading systems.
4. Monitoring: in function of awareness raising, source and loophole detection & further policy planning.
5. Subsidies, Taxes & Levies: direct positive and negative economic incentives.
6. Research Oriented Measures: e.g. on prevention, recyclability & biodegradability.

As a first step to address marine debris issues, China proposed APEC Economies to collaborate on formulating uniform packaging standards for imported and exported products to prevent over-packaging. Additionally, form the product material substitution recommendation lists on the premise of meeting the capacity.

3.5 PERU

3.5.1 Laws & Regulations

A summary of relevant solid waste management laws and regulations in Peru.

Table 129: Waste Management Laws & Regulations in Peru

Laws & Regulations	Brief Description	Waste Management Processes	Sources
Legislative Decree No. 1278	• Aims to establish responsibilities of society to use materials efficiently and ensure sound management of waste. • Approves the Law of Integral Management of Solid Waste	Minimization	Solid wastes;
Law on the integral management of solid waste (Replaced Law N° 27314: General Law of Solid Waste)	• Emphasize the importance of circular economy, recovery and recycling of waste, extended responsibility to the producer, shared responsibility and protection for the environment and human health. • Waste collection, transportation and disposal by authorized personnel. • Waste storage and disposal by approved facilities	Collection, storage, transportation, treatment, disposal (landfill)	Solid wastes from fishing activity and aquaculture; comprises of hazardous & non-hazardous solid wastes.

Peru has specific law (Supreme Decree N° 013-2018-MINAM) which promotes the reduction of single-use plastics and responsible consumption of these plastics in entities of the Executive Power (governmental authorities) and one of the solutions is to replace them with reusable plastics. In order to prevent marine debris, a law (Directorate Resolution N° 0766-2003/DCG) has been passed reducing the discharge of waste generated by ships and the waste from the cargo transported to the sea. The Directorate of Maritime Captaincy is responsible for monitoring of vessels at sea under jurisdiction of Peru and prevent them from disposal of waste into the sea.

Funding to prevent marine debris is available at the local and provincial level for the management of municipal waste and its disposal.

The Peruvian Marine Research Institute (IMARPE) is conducting research to assess the impact of microplastics on Peruvian coastal species. Preliminary research has identified low level of microplastics in the marine species. Research will continue to evaluate the degree of microplastics contamination, impact to human health and sustainability of the fisheries activities in Peruvian seas.

3.5.2 Land-based Marine Debris Preventive Measures

Based on the survey response, Peru's main sources of land-based marine debris are from:

1. Toilet and sewer overflow (most common)
2. Industrial activities
3. Household and general littering
4. Tourism and coastal recreation
5. Waste management and collection (least common)

For mitigating of marine debris at source, Peru has implemented the Supreme Decree N° 013-2018-MINAM which promotes the reduction of single-use plastics, responsible consumption by governmental and replacing them with biodegradable plastics. In order to be compliance, The National Service of Natural Protected Areas by the State (Sernanp) has prohibited single-use plastics in the Historic Sanctuary of Machu Picchu and other protected natural areas.

The land-based marine debris creates a growing concern in Peruvian population due to the impact of these solid wastes that littered the sea and beaches.

One of the remedial measures suggested by Peru for land-based marine debris include raising awareness on protection of the sea and preventing marine debris pollution. This should be led by the Peruvian authorities including Ministries, regional, provincial and local governments. Sanctioning measures must also be applied to individuals who violates the law, creating negative impacts to the sea. A more severe sanctions (or law) may be considered. Peru's the Ministry of Environment should also collaborate with other entities in the environment field, to further develop relevant environmental management to address marine debris issue. In an example, the Ministry of Production developed a program to clean the seabed at critical places (or hotspots) with marine debris.

3.5.3 Sea-based Marine Debris Preventive Measures

Based on the survey response, Peru's main sources of sea-based marine debris are from:

1. Offshore industries (most common)
2. Professional and recreational fishing
3. Port activities
4. Shipping Sector
5. Aquaculture (least common)

It should be noted that the above source is ranked partially based on effluent (wastewater) discharge and not entirely on disposal of solid wastes creating marine debris.

The submarine emissary installed by the fishing plants is required to conduct an environmental impact study to assess the impact on the marine environment as illegal disposal of solid wastes may occur. The environmental impact study shall be approved by the Ministry of Production, regarding the authorization of the use of the aquatic area granted by the Directorate of Captaincy and Coast Guard.

Remedial measures for sea-based marine debris include awareness raising on marine protection and preventing pollution. Implementation of fishing vessels surveillance should be implemented to prevent illegal disposal of waste into the sea. Surveillance of beaches should be increased to prevent illegal dumping of rubbish.

3.5.4 Marine Debris Monitoring

The marine debris monitoring method implemented by Peru and their details are provided in Table 13~~Table 10~~ below.

Table 13~~10~~: Marine Debris Monitoring in Peru

Monitoring Methods	Source Identification Methods	Detailed Description	Findings
Beach survey (International Coastal Clean Up)	Sorting	• Conducted as part of International Coastal Clean Up involving more than 200 public & private institutions supporting the campaign. • Frequency: Annually. • 100 different areas including beaches, rivers & lakes.	Plastic materials & others

3.5.5 Current Measures on Plastic Wastes

The first measure on plastic wastes taken by Peru is the implementation of laws which promote single-use plastic reduction (as described above Supreme Decree N° 013-2018-MINAM). Governmental entities are encouraged to use biodegradable plastics, and several Peru's Natural Protected Areas have also prohibited the use of single-use plastics. The distribution of the plastic bags to commercial stores and markets was also restricted. The Ministry of Environment of Peru has also launched a website to recognise companies which sells eco-friendly products, plastic alternatives or do not use plastics in their production processes and packaging.

The preventive measures for plastic wastes from marine source include the surveillance of fishing vessels by Peru's Captaincy Department (preventing illegal disposal) and awareness training for artisanal fishermen[6] on proper plastic waste management.

In cases where plastics ended up in beach and seabed (underwater), cleanup efforts were initiated as a remedial measure.

[6] Artisanal fishermen are those who use traditional fishing gears and are relatively low-technology for fisheries.

3.5.6 Challenges & Opportunities

The main challenge with marine debris issue for Peru is the lack of personnel, resources & financial support for surveillance of illegal waste disposal from vessels at sea and at beaches.

The 5 most relevant gaps on plastic packaging in Peru is as identified in Table 14~~Table 11~~ below:

Table 14~~11~~: Most Relevant Plastic Packaging Gaps in Peru

Rank	Most relevant gaps in plastic packaging	Description
1	Inappropriate behaviour when disposing litter (e.g. during activities along the coast, particularly impact related to tourism, etc.)	Awareness training required for people to understand the harmful effects of improper disposal of solid wastes into the ocean.
2	Lack of awareness or incentives to separate waste for recycling	Training required for people to sort solid wastes (esp. plastics) for recycling.
3	Inappropriate behaviour on waste management in industries and retailers (losses of material, etc.)	Awareness training required for people to understand the harmful effects of improper disposal of solid wastes into the ocean.
4	Deficient separate collection infrastructure for plastic packaging waste	None.
5	Inappropriate waste treatment facilities (e.g. landfills close to the coast, etc.)	The competent authority should monitor these facilities.

Direct preventive measures worth considering by Peru and ranked based on the level of priority are:

1. Fishing for litter (Highest priority)
2. Enhanced waste water treatment
3. Eco-design to avoid waste generation or to enhance reuse or recyclability
4. Enhanced waste treatment chains, avoiding escapes of waste to the environment (e.g. daily covered or better managed landfills)
5. Better acceptance facilities for ships

Indirect preventive measures worth considering by Peru and ranked based on the level of priority are:

1. Legal & Obligations: command and control measures (Highest priority)
2. Monitoring: in function of awareness raising, source and loophole detection & further policy planning.
3. Research Oriented Measures: e.g. on prevention, recyclability & biodegradability.
4. Awareness Raising & Information: measures focusing on changing behaviour, labelling and certification, communication, education, training & etc
5. Enhanced Enforcement

Peru recommendations for tackling marine debris are establishing regional action plans, guidelines or principles on marine debris prevention and management, and provide training of marine debris specialists.

3.6 KOREA

3.6.1 Laws & Regulations

A summary of relevant solid waste management laws and regulations in Korea are described in Table 15~~Table 12~~ below.

Table 15~~12~~: Waste Management Laws & Regulations in Korea

Laws & Regulations	Brief Description	Waste Management Processes	Sources
Marine Environment Management Act	• Prevention of marine pollution (discharge of pollutants) caused by ships • Prevention of any land-based wastes into sea • The Minister of Oceans and Fisheries shall formulate and implement an ocean waste collection and disposal plan to effectively collect and dispose of wastes discharged or flowing into the sea. • Monetary rewards for reporting of such marine pollution activities, in this case, dumping of waste (from land or sea) into the ocean.	Collection, storage, transportation	Land- and sea-based
Wastes Control Act	• Ensure the proper management of waste and safeguard public health	Collection, transportation and disposal	General wastes

Korea has adopted the MARPOL Annex V in its Marine Environment Management Act, ensuring ships collect, store, process their wastes in accordance to a waste management plan and keeping a record of these processed wastes.

3.6.2 Sources of Marine Debris

Based on the survey response, Korea's main sources of ***land-based*** marine debris are from:

1. Tourism and coastal recreation (most common)
2. Household and general littering
3. Industrial activities
4. Waste management and collection
5. Toilet and sewer overflow (least common)

Korea's main sources of ***sea-based*** marine debris are from:

1. Professional and recreational fishing (most common)
2. Aquaculture
3. Shipping sector
4. Port activities
5. Other offshore activities (least common)

3.6.3 Preventive Measures

An initiative, Management Strategy for Marine Plastic Waste, has been established in May 2019, which aims to reduce 50 percent of the current marine plastic volume by 2030. This goal is achieved through establishment of action plans including reduction strategy per source of marine plastic waste, improvement on collection of marine plastic from ships, expedite processing and recycling of marine plastic, strengthen foundations for plastic waste management and improve social perception of marine waste (awareness training). For example, Comprehensive Strategy for Management of Recyclable Waste has been introduced to improve plan of a product's lifecycle including manufacturing, distribution, collection and recycling.

The main preventive measures implemented include:

1. Restriction on use of plastic packaging (and voluntary reduction of packaging by major distribution company)
2. Prevent the sale of plastic bags at departmental stores, retail stores, large shopping facilities.
3. Disposable products to reduce waste generated and the collection of garbage from major streams in Korea.

These policies and measures developed by Korea follow a systematic approach, tailoring to local circumstances, considering budget and feedbacks from stakeholders (e.g. experts & environmental groups).

3.6.4 Remedial Measures

The main remedial actions by Korea is beach cleanup and collection of floating wastes from the ocean. These cleanup activities involve the local government, voluntary groups or public institutions. An example is the implementation of coastal cleanup program by the Korea Ocean Environment Management Corporation (KOEM). Debris collected mostly originate from fishery-related activities hence education and awareness raising of the fishermen were established. Fishermen are also compensated for collecting debris found during fishing or voluntary collection of discarded fishing gear.

Debris collected, comprises mainly of Styrofoam, waste fishing net and plastics, seems to have originated from fishery-related activities. An action plan to educate and public awareness of fishermen was proposed.

Based on the survey responses, some of the waste management measures that are most relevant (as ranked) to Korea are:

1. Improved cleaning operations in certain areas
2. Promotion of waste collection at the port
3. Improved enforcement on improper disposal into waterways
4. Ban of certain products (e.g. single-use plastics)
5. Awareness raising targeting littering and improper disposal of fishing gear
6. Promote recycling campaigns
7. Voluntary beach clean-up programs
8. Fishing for litter (i.e. picking up litter caught in nets during fishing activities)
9. Redesign of products (e.g. alternative biodegradable materials or reduce the use of non-biodegradable components in the product)

10. Smoking ban or zoning on beaches

3.6.5 Funding & Research

Korea has also provided the Marine Product Development Fund, which has allocated partial funds for marine waste-related purposes. An example of a funded project is the Marine Waste Treatment Project that support the improvement of fishing grounds productivity in nearby waters.

An ongoing research study on the environmental risk of marine plastic conducted by Korea Institute of Ocean Science and Technology (KIOST) aims to survey domestic pollution caused by marine microplastics and its influence on marine organisms.

3.6.6 Marine Debris Monitoring

Marine debris is monitored as part of beach cleanup activities by various organisations (public or private) and voluntary groups. Details of Korea's marine debris monitoring are provided in Table 16~~Table 13~~ below.

Table 1613: Marine Debris Monitoring in Korea

Monitoring Methods	Source Identification Methods	Detailed Description	Findings
Beach cleanup & collection	Visual identification and classification	• Monitored by NGO • Location: 40 beaches • Frequency: 6 times a year	Mainly plastics

The marine debris monitoring revealed many discarded Styrofoam buoys leading to the launched of a project to create an eco-friendly buoy.

3.6.7 Challenges

The main challenge for Korea on marine debris pollution is the lack of relevant marine debris data (i.e. existing quantity of marine debris). Research efforts has been made to identify the quantity of current marine debris through routes. As a result, concentrated management of areas with large quantity of marine debris (through prediction of movement routes) to improve debris collection rates.

The 5 most relevant gaps on plastic packaging in Korea is as identified in Table 11~~Table 8~~ below:

Table 178: Most Relevant Plastic Packaging Gaps in China

Rank	Most relevant gaps in plastic packaging	Explanation
1	Inappropriate behaviour when disposing litter (e.g. during activities along the coast, particularly impact related to tourism, etc.)	Most important factor is increased interest of general public in (and willingness to put into practice) solutions to marine/environmental problems.

Rank	Most relevant gaps in plastic packaging	Explanation
2	Production and consumption patterns based on single-use/disposable items rather than reduce and re-use	Changes in consumption patterns (increase in single-person households, increase in online shopping, etc.), and increase in discarded disposable products due to excessive packaging.
3	Lack of measures to reduce the production of plastic packaging (e.g. bags, bottles, EPS fish boxes)	-
4	Decoupling between design/production and recycling – products are designed without its whole life-cycle in view	-
5	Deficient separate collection infrastructure for plastic packaging waste	-

3.6.8 Opportunities

Direct preventive measures worth considering by Korea and ranked based on the level of priority are:

1. Fishing for litter (Highest priority)
2. Beach clean-up actions
3. Inland clean-up actions
4. Enhanced waste collection on land
5. Better acceptance facilities for ships (Lowest priority)

Indirect preventive measures worth considering by Korea and ranked based on the level of priority are:

1. Legal & Obligations: command and control measures. (Highest priority)
2. Awareness Raising & Information: measures focusing on changing behaviour, labelling and certification, communication, education, training & etc Inland clean-up actions
3. Subsidies, Taxes & Levies: direct positive and negative economic incentives.
4. Research Oriented Measures: e.g. on prevention, recyclability & biodegradability.
5. Other Economic of Market-based Instruments: green public procurement, purchase specifications, price regulation, costs for goods and services, fee-based systems & trading systems. (Lowest priority)

The main recommendation for APEC Economies to collaborate is the Standardization of research methodology and creation of opportunities to present/share model examples.

3.7 SINGAPORE

3.7.1 Laws & Regulations

A summary of relevant solid waste management laws and regulations in Singapore are described in Table 13 below.

Table 1813: Waste Management Laws & Regulations in Singapore

Laws & Regulations	Brief Description	Waste Management Processes	Sources
Environmental Public Health Act	• Aim to keep Singapore clean by protecting Singapore's resources from pollution and maintaining a high level of public health.	Collection, storage, transportation, treatment, disposal (incineration or landfill)	Waste from domestic and trade premises
Environmental Public Health (General Waste Collection) Regulations	• Cover licensing of General Waste Collector, transportation of different class of general wastes, and disposal of wastes. • General waste collection, transportation and disposal must be performed by licensed General Waste Collector.	Collection, storage, transportation, treatment, disposal (incineration or landfill)	Non-toxic waste from domestic and trade premises
Environmental Public Health (Toxic Industrial Waste) Regulations	• Cover licensing of Toxic Waste Collector, and collection, transportation and disposal of toxic industrial wastes. • Toxic industrial waste collection, transportation and disposal must be performed by licensed Toxic Industrial Waste Collector.	Collection, storage, transportation, treatment, disposal (incineration or landfill)	Toxic waste from industrial premises
Environmental Protection and Management Act (EPMA)	• Provide protection for the protection and management of the environment and resource conservation.	Storage, removal and disposal	Toxic waste from industrial premises

Singapore implements strict regulations which are governed by National Environment Agency (NEA) to ensure that the waste is properly managed and disposed. NEA has been encouraging people and industries to reduce their waste, reuse where possible and increase their rate of recycling. Singapore currently has only one active landfill. To conserve the limited landfill space, incineration of waste is necessary to reduce the volume going to the landfill.

The domestic legislation and regulations on pollution control and waste management aim to contribute to the prevention and reduction of marine pollution through (i) management of pollution from land-based sources; (ii) management of water pollution and quality in inland water bodies and coastal areas and (iii) meet the obligations under International Maritime Organization's (IMO) International Convention for the Prevention of Pollution from Ships (MARPOL), the main international convention covering prevention of pollution of the marine environment by ships.

3.7.2 International Convention

MARPOL is implemented under the Prevention of Pollution of the Sea Act (PPSA) and its associated regulations, which provides powers to impose fines of up to $20,000 or imprisonment terms of up to 2 years, or both, for non-compliances with MARPOL. The

regulations are applicable to (i) Singapore-registered ships wherever they may be; and (ii) foreign-registered ships in Singapore waters.

Singapore is also a party to the Basel Convention which aims to protect human health and the environment against the adverse effects of hazardous waste through reducing their transboundary movement between economies. Singapore implements the Prior-Informed Consent (PIC) procedure for the transboundary movement (i.e. export, import and transit) of hazardous wastes and other wastes that are controlled under the Basel Convention. Singapore implements the obligations of the Convention through the Hazardous Waste (Control of Export, Import and Transit) Act and Hazardous Waste (Control of Export, Import and Transit) Regulations. Companies importing, exporting or transiting hazardous waste, are required to apply for a Basel Permit from NEA (Pollution Control Department, PCD) with the necessary supporting documents.

3.7.3 Land-based Marine Debris Preventive Measures

Given Singapore's comprehensive and integrated solid waste management and collection system to minimise waste at the source and collect all waste for proper disposal, the amount of waste that is washed into the marine environment is not significant.

Singapore has a comprehensive and integrated solid waste management and collection system to minimise waste at the source and collect all waste for proper disposal so that waste will not be washed into the marine environment. All other incinerable wastes that are not segregated at source for recycling are disposed of at waste-to-energy (WTE) plants fitted with modern flue gas treatment systems to remove pollutants. Ash from the WTE process, together with other non-incinerable wastes, are disposed of at the off-shore Semakau Landfill.

Singapore government adopts a multi-prong strategy (prevention, legislation and enforcement, monitoring and education) for environmental management. Industries are required to comply with the relevant NEA's environmental regulations as listed in Section 3.17.1.

Singapore has a strict anti-littering enforcement regime, with first-time littering offenders issued a $300 monetary penalty. There are heavier penalties for recalcitrant offenders who are prosecuted in court, including fines up to $10,000 and/or Corrective Work Orders, which requires the offender to pick litter at public areas for a period of time. This enforcement regime aims to deter littering.

There is a routine cleaning regime put in place for all inland waterways to remove land-based litter and flotsam by NEA. Vertical gratings, litter traps and float booms have also been installed where appropriate as part of the drainage network to trap debris and litter. In any case, two-thirds of Singapore is a water catchment area and the drains and canals lead to a reservoir instead of the open sea. For waterways that lead to the sea, the aforementioned cleaning regime and litter traps prevent litter from flowing out into the sea.

Fostering ownership through cooperation with environmental groups such as the Public Hygiene Council (PHC), International Coastal Cleanup Singapore (ICCS) and the Waterways Watch Society (WWS).

3.7.4 Sea-based Marine Debris Preventive Measures

Ship-based pollution in Singapore is covered under our MARPOL obligations and Singapore has a small commercial fishing and aquaculture industry.

Singapore has strict regulations that forbids any debris to be discarded into watercourses and the marine environment. For example, discharge from the marine outfalls of the Water Reclamation Plants and Desalination Plants is not allowed to contain debris or flotsam. Any debris found in used water or seawater is mechanically screened and removed upstream and disposed by incineration.

In addition, Singapore conducts inspections on both Singapore-registered ships and foreign-registered ships in Singapore's port to ensure that they comply with the regulations on garbage disposal and that anti-pollution measures are in place. Ships are also required to maintain garbage record and management plans for verification by inspectors. As part of MARPOL obligations, the Maritime and Port Authority of Singapore (MPA) deploys garbage collection craft daily at scheduled timings to collect garbage from ships at the anchorages. No additional fees are collected from ships for disposal of garbage unless special requests to dispose garbage at a specific timing and location are made, in which case a fee will be charged. Further, MPA's Port Inspectors patrol Singapore's port waters to ensure that ships in the Port of Singapore do not illegally discharge waste, oil, garbage and sewage. To enhance the effectiveness of patrols, the fleet of Next-Generation Patrol Craft will be equipped with enhanced surveillance and response capabilities.

3.7.5 Marine Debris Monitoring

The marine debris monitoring method implemented by Singapore and their details are provided in Table 19~~Table 14~~ below.

Table 19~~14~~: Marine Debris Monitoring in Singapore

Monitoring Methods	Source Identification Methods	Detailed Description	Findings
NUS-NParks Marine Debris Monitoring Programme	Derived from literature review of publications (e.g. UNEP/IOC Guidelines on Survey and Monitoring of Marine Litter, Australian Marine Debris Initiative, GESAMP reports)	• When: Between December 2017 to February 2019 • Frequency: Six sites were monitored every two months for 15 months. • Who: Public volunteers, schools, corporate groups, government agencies, and other organised groups • Where: Six beach locations (Lim Chu Kang, Selimang Beach, Pasir Ris Beach, Pulau Ubin, Tanah Merah Beach, Small Sister's Island) in Singapore	The data is currently being analysed.
International Coastal Cleanup (Singapore)	Ocean Conservancy's International Coastal Cleanup data card	• When: Every September since 1992 • Frequency: Annually • Who: Public volunteers and organised groups • Where: 53 coastal locations in Singapore	Top three common items in 2018 are foam pieces, cigarette butts, plastic pieces, beverage bottles

Monitoring Methods	Source Identification Methods	Detailed Description	Findings
			(plastic) and straws/stirrers.[7]
Singapore Reefs' Dive Cleanups – Project AWARE	Project AWARE's Dive Against Debris data card	• When: Since 2017 • Frequency: Quarterly • Who: Dive volunteers • Where: Southern Islands of Singapore (i.e. Lazarus Island and Sisters' Islands Marine Park)	The most common material collected is plastics (57%), followed by metal (15%), glass and ceramics (5%). Top three plastic items collected are bottles, food wrappers and cutlery.
Establish baseline data on marine debris	Research on macro-debris and microplastics	• There is an ongoing research collaboration with the National University of Singapore to establish baseline data on marine debris in Singapore's shores, develop a citizen-science programme to monitor macro-debris and microplastics and facilitate dialogue with stakeholders towards recommendations for management approaches.	In the progress

3.7.6 Current Measures on Plastic Wastes

Managing plastic and packaging waste is one of the key priorities of Singapore by taking a holistic 3R (Reduce, Reuse, Recycle) approach to managing plastic and packaging waste. The objective is to reduce excessive use of all disposables, including single-use plastics, and to achieve an overall recycling rate of 70% by 2030 with the participation of all sectors including public, private and people.

Starting with upstream reduction, the Government, industry and non-government organisations (NGOs) jointly launched The Singapore Packaging Agreement (SPA) in 2007 to reduce packaging waste. Since its inception, SPA signatories have cumulatively reduced about 54,000 tonnes of packaging waste. To build on the foundation of the SPA, Singapore will be introducing mandatory reporting of packaging data, including plastics, and 3R (reduce, reuse and recycle) plans for packaging in 2020. This also builds on an existing mandatory waste reporting framework for large malls and hotels, which will be expanded to all large industrial and commercial premises, including large convention and exhibition centres, in 2020. The mandatory packaging reporting framework will also lay the foundation of an Extended Producer Responsibility (EPR) framework for managing packaging waste including plastics. This ensures producers are responsible for the collection and recycling of the materials they use to package their products. The aim is to have the EPR system for packaging waste management in place by 2025.

The government also supports ground-up initiatives on reducing packaging use through funding support. One such initiative was NGO - Zero Waste SG's Bring Your Own (BYO)

[7] http://coastalcleanup.nus.edu.sg/results/2018/2018.htm

campaign, aimed at encouraging consumers to use reusable bags and containers when they buy takeaway food, beverages and groceries. Since 2017, more than 400 retail outlets have joined the campaign, providing incentives to customers who bring their own reusables. This has saved approximately two million pieces of plastic disposables and packaging. Leveraging the success of BYO, the government also supported Zero Waste SG with the Partnership Fund to further develop the campaign in 2019 into Bring Your Own Bag (BYOB) to focus on reducing disposable plastic bag usage.

To encourage residents to recycle, all residential premises have convenient access to recycling services, including the collection of plastic recyclables, through the National Recycling Program. Recyclables including plastics are collected through a commingled system, then sorted, baled and sent for recycling.

Singapore's approach has been to reduce the excessive use of all types of disposables, not just single-use plastics, and to promote the use of reusables. Singapore does not target plastics alone, as this may simply result in their substitution by other types of materials which are not necessarily better for the environment. Many households also use plastic bags from supermarkets to bag their household wastes before disposal. To encourage consumers to reduce the use of disposables, the NEA launched the "Say YES to Waste Less" campaign in 2019 as part of the Year Towards Zero Waste movement. 59 partners operating over 1,600 premises ranging from food and beverage establishments, supermarkets, and hotels have come forward to partner the NEA in this nation-wide endeavour.

3.7.7 Challenges & Opportunities

The challenges with marine debris issue for Singapore have been identified in the table below:

Challenges	Measures	Effectiveness
Ensuring proper solid waste management	Environmental Protection and Management Act (EPMA) and the Environmental Public Health Act (EPHA).	Effective
Controlling discharges into waterways	Environmental Protection and Management Act (EPMA) and the Environmental Public Health Act (EPHA).	Effective

Singapore is developing the local recycling industry to better extract resources from waste and close the waste loop domestically. NEA is currently studying recycling solutions and technologies and assessing their suitability for adoption in Singapore. For example, mechanical recycling to turn waste plastics into plastic pellets for manufacturing new products, or chemical recycling to turn plastic waste into chemical feedstock or fuel. These are efforts which would help transform the Environmental Services industry, creating new opportunities that will grow local enterprises and better jobs for Singaporeans.

Suggestion: APEC can consider encouraging economies to strengthen their waste management systems as well as increase the percentage of wastewater treated. This will help minimize waste at the source and the amount of waste discharged into the ocean.

4. SUMMARY OF SURVEY RESPONSES

Summary of APEC Economies' Laws & Regulations on Waste Management and Marine Debris

APEC Economies	Laws & Regulations
Chile	• Regulates proper waste management (collection, sorting, recycling, storage, transportation & disposal) • Prevent dumping of waste on beaches (land-based) • Prevent illegal dumping from ships and aquaculture facilities (sea-based) at ports, rivers & lakes
Japan	• Regulates proper waste management (collection, sorting, recycling, storage, transportation & disposal) • Prevent dumping of waste on beaches (land-based) • Prevent dumping of waste from ships or any offshore facilities into ocean • Stipulates remedial actions to cleanup marine debris and develop a monitoring plan
New Zealand	• Regulates proper waste management (collection, sorting, recycling, storage, transportation & disposal) • Prevent discharge of wastes from ships into the ocean • Ban of plastic bags
China	• Regulates proper waste management (collection, sorting, recycling, storage, transportation & disposal) • Regulates construction waste management (EIA with preventive & mitigation measures and monitoring plan) • Prevent illegal dumping of waste into ocean • Regulates the recovery and disposal of waste electrical product
Peru	• Regulates proper waste management (collection, sorting, recycling, storage, transportation & disposal) • Policies on single-use plastics reduction • Prevent discharge of wastes from ships into the ocean
Korea	• Regulates proper waste management (collection, transportation & disposal) • Prevent discharge of wastes from ships into the ocean
Singapore	• Regulates proper waste management (collection, sorting, recycling, storage, transportation & disposal) • Regulates any water pollutions from land-based sources • Prevent pollutions from ships into the ocean

In summary, the initial key findings from APEC Economies on the marine debris are:

4.1.1 Laws & Regulations

a. **General management of domestic and industrial wastes are established in most economies**. These regulations include proper waste management, anti-littering, prevent dumping of wastes on land (esp. beaches) and/or at sea from any ships, vessels. **Minimally, waste management laws must be enforced using appropriate incentives and penalties.** Subsidies, taxes and levies could be an effective instrument for effective waste management and to modify the behaviours of producers and consumers (Gallo and Bongiolatti, 2013).

b. **Laws specific to management of plastic waste & recycling may not be comprehensively adopted by some economies.** Most economies in this report

agree that there is lack of awareness or incentives to separate waste for recycling. China highlighted that in some cities, the classification of plastic garbage is strictly enforced and failure to classify plastic garbage according to the requirements will be fined. Japan has the National Action Plan for Marine Plastic Litter that focuses on prevention of marine litter form entering the ocean. Singapore's mentioned that their approach has been to reduce the excessive use of all types of disposables, not just single-use plastics, and to promote the use of reusables. As such, Singapore does not target plastics alone, as this may simply result in their substitution by other types of materials which are not necessarily better for the environment.

c. Measures regarding marine debris or plastics waste management from international conventions are incorporated by many economies in their legislations. **Economies should consider stronger alignment to policies from international conventions.** Challenge remains in domestic implementation. A 2018 UNEP report noted that while many economies are party to various international marine related conventions, domestic implementation in many locations is poor due to capacity and cultural barriers reasons, among others. Peru have mentioned that there is the lack of personnel, resources & financial support for surveillance of illegal waste disposal from vessels at sea and at beaches.

4.1.2 Preventive measures

d. Reduction of plastic use
    i. **Education**: awareness trainings on impact of marine debris pollution and benefit of plastic recycling to various stakeholder are conducted by many economies. **Awareness training for stakeholders in rural areas may be an issue; partnerships with local or international NGOs could be beneficial.**
    ii. **Alternative to plastics:** several economies have promoted the research to identify alternative materials to plastics. **Funding should be provided to identify innovative solutions. Collaborations can be established between government, public sectors and even universities (at regional or international level).** In Indonesia, it was proposed to build industries that use biodegradable materials such as cassava and seaweed to produce plastic alternatives (UNEP, 2018).
    iii. **Economy-wide targets:** some economies adopted economy-wide targets for recycling or plastic reduction. For example, Chile highlighted their commitments that 100% of plastic containers and packaging must be designed to be recyclable, reusable or compostable; and 1/3 of residential and non-domiciliary plastic containers and packaging must be effectively recycled, reused or composted.
    This requires establishing a comprehensive action plan that can be communicated to various stakeholders.

4.1.3 Remedial measures

e. Many economies have beach cleanup activities as a remedial measure, and some has cleanup of marine debris floating on sea or even those at the seabed (underwater). **Cleanup of floating debris and debris in seabed should be considered with adequate financial support and resources to conduct these operations. Authorities can take the lead and encourage participation from private institutions and public (volunteers).**

4.1.4 Monitoring

f. Many methods adopted by economies were limited to manual counting during beach cleanup. There is a need to have a **more effective monitoring method, essentially improvement in technology, to measure marine debris (plastic or microplastics) in the ocean.**
g. Marine debris data collected as part of beach cleanup and classification done to identify type of wastes, but there is a lack of assessment on source of marine debris and utilizing these data to develop effective policies and measures.

4.1.5 Challenges

h. **Accessibility to rural areas** to implement a robust waste management system (and difficult to enforce such waste management laws). China mentioned about the insufficient collection coverage of municipal waste and lesser frequency of collection of recyclables in rural areas.
i. **Insufficient awareness** training to various stakeholders including public, communities, industries. Greater awareness could bring high impact result. For example, high rates of collection in the Philippines might be due to the extensive involvement of local communities in waste-collection services (UNEP 2018).
j. **Lack of marine debris data** to understand its impact. New Zealand highlighted the main challenge of having relevant marine debris data to understand the extent of impact and the gaps in materials recovery and waste infrastructure; while Korea underlined the challenge of accurately measure the quatity of MD. While China has required Governmental District/City and solid waste management organisations to report solid wastes data including types, production quantity and status of disposal. In overcoming this data deficiency, governments may consider to work with local universities. In Singapore, there is an ongoing research collaboration with the National University of Singapore to establish baseline data on marine debris in Singapore's shores, develop a citizen-science programme to monitor macro-debris and microplastics and facilitate dialogue with stakeholders towards recommendations for management approaches.
k. **Lack of materials recovery and waste infrastructure**. New Zealand highlighted that more materials recovery and local re-processing infrastructure would help to shift to a more sustainable and efficient circular economy. China

underlined the issue of inadequate waste management infrastructure in rural areas.